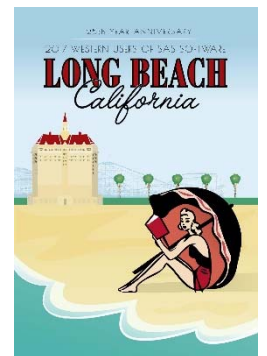




How SAS Thinks SAS Basics I

Susan J. Slaughter, Avocet Solutions



What is SAS Essentials?

- Section for people new to SAS
- Core presentations
 1. How SAS Thinks
 2. Introduction to DATA Step Programming
 3. Introduction to SAS Procedures
- We'll go fast
 - Slides are on my website
- Pay attention because there will be a test
 - Do you have the handout?

What is SAS?

- Originally stood for Statistical Analysis System
- Since 1980s officially no longer an acronym
- Pronounced “sass” not “S. A. S.”
- Better answers:
 - Company named SAS Institute
 - Family of software products
 - Programming language



What is the SAS language?

- SAS is a fourth generation language with features for data manipulation and analysis.
- Generations of computer languages
 - First—binary
 - Second—machine code
 - Third—"high-level" languages
 - Fourth—built-in features such as query language
- One generation is not better than another.



Susan says

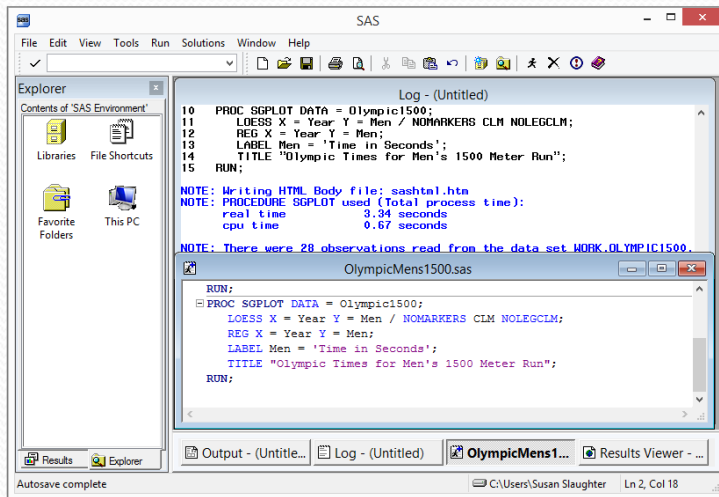
- This is an overview
 - Keep in mind that there are many exceptions
- There are always at least 3 ways to do anything in SAS
 - Don't worry about it
- SAS is a big language
 - No one knows it all
- SAS is a language of defaults
 - Once you know what the default is, you can override it

Ways to run SAS

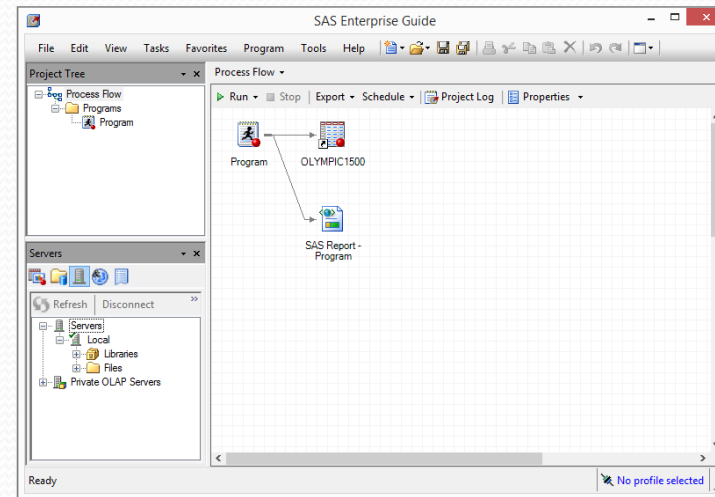
- You have a choice of environments
- These 3 are included with Base SAS:
 - SAS windowing environment (“Display Manager”)
 - SAS Enterprise Guide
 - SAS Studio

Ways to run SAS

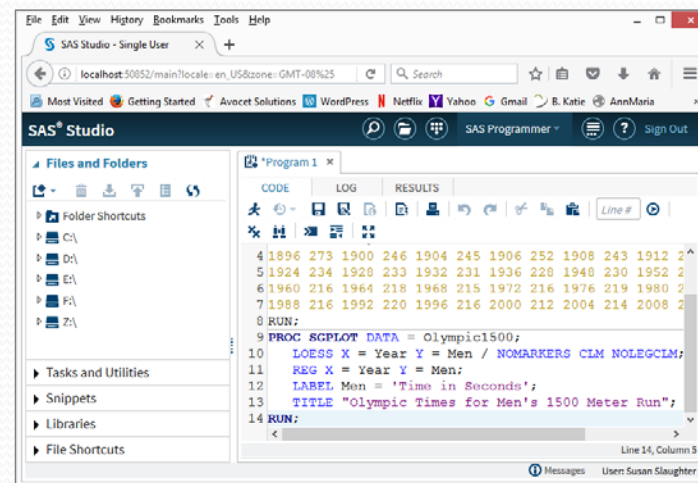
Display Manager



Enterprise Guide



SAS Studio



SAS Studio

- Many different ways to get it
 - SAS Studio (Single-User, Basic, and Enterprise versions)
 - Part of standard SAS installation
 - Free with Base SAS license
 - SAS University Edition
 - Download
 - Free for learning!
 - SAS OnDemand for Academics
 - Use online
 - Free for learning!



SAS data sets

- Before SAS can use data, must be in a SAS data set
- SAS data sets are comprised of two parts
 - Data
 - Descriptor (self-documenting)
- When you run SAS programs, they are compiled and then executed
 - What does this have to do with SAS data sets?
 - Descriptor is constructed during compilation
 - Data are read during execution

SAS data sets

Descriptor portion contains:

- Information about data set
 - Name of data set
 - Date created
 - Number of observations and variables
- Information about variables
 - Name of variable
 - Type (character or numeric)
 - Length (in bytes)
 - Label (if any)
 - Informat and format (if any)



SAS data sets

- SAS data sets are rectangular
 - Records = rows = observations
 - Fields = columns = variables
- Two types of variables

Numeric

Numbers

Add, subtract

Period (.) for missing

Character

Letters, numerals, \$#@!

Cannot add, subtract

Blank for missing

- Some data values can be numeric or character
 - Example: ID numbers

	ID	Name	Age	Major
1	78374	Thomas	21	
2	75638	Cathy	.	STA
3	78634	David	20	ENG

Dates in SAS

- SAS date values are number of days since January 1, 1960

<u>Date</u>	<u>SAS date value</u>
December 31, 1959	-1
January 1, 1960	0
January 1, 1961	366
September 20, 2017	21082

- Stored as ordinary numeric data values
- How many days old are you?

DaysOld = TodayDate - BirthDate;

SAS variable names

- Rules for names of variables
 - Start with letter or underscore
 - Contain only letters, numerals and underscores
 - Up to 32 characters long
- Can be upper or lower case
 - SAS doesn't care
 - Age, age, AGE and AgE all refer to the same variable
 - But SAS remembers the case of first occurrence of variables

SAS data set names

- SAS data set names always have two levels:
libref.membername
- Libref
 - SAS data library reference
 - Specifies location (disk, folder, path)
- Member name
 - Individual data set in that library
- Separated by a period

SAS data libraries

- SAS comes with built-in data libraries
 - WORK
 - Temporary = erased when you exit SAS
 - SASHELP
 - Permanent = not erased
 - Read-only, sample data sets
 - SASUSER
 - Permanent = not erased
 - Read-write, for your data sets
- Define your own SAS data libraries

SAS data set names

MySASLib.students

- two level name
- library= MySASLib
- member name = students
- will be permanent
- not erased by SAS

students

- one level name
- library = WORK
- member name = students
- will be temporary
- erased by SAS
- real name WORK.students

SAS data libraries

- Many ways to create permanent SAS data libraries
 - Depend on operating system
- LIBNAME statement always works
 - General form (on Windows):

```
LIBNAME libref 'drive:\directory-path' ;
```

- Example:

```
LIBNAME mysas 'c:\MySASLib' ;
```

Getting data into SAS

There are many ways

- Type it in yourself
 - Viewtable window in DM, Data Grid in EG
- DATA step with INPUT statement
- Import wizard
- PROC IMPORT
- SAS data engines such as SPSS
- SAS/ACCESS for files such as Oracle

SAS programs

- First rule of SAS programming
 - Every SAS statement ends with a semicolon;
- No rules for formatting of code
 - Upper or lowercase
 - I will use uppercase for keywords, mixed case for variables
 - More than one statement per line
 - Statements can continue on next line
 - Any indention or none
 - Can be completely unreadable—not recommended

SAS programs

- You should always include comments in your programs!

- Two styles

```
* This is a comment;
```

```
/* This is another comment */
```

- Comments might include

- Your name
- Date
- Purpose
- Describe any non-obvious bits of code

DATA versus PROC steps

- Two basic parts of SAS programs

DATA step

Begin with DATA statement

Input and modify data

Create SAS data set

Flexibility of programming

PROC step

Begin with PROC statement

Perform analysis or task

Produce report

Like filling out a form

- This is a simplification, but good guideline
- Common mistake made by beginners is to use statements in wrong kind of step

DATA versus PROC steps

- A simple example

```
DATA temps;  
    Fahrenheit = 68;  
    Celsius = (Fahrenheit - 32) * 0.5556;  
PROC PRINT DATA = temps;  
    TITLE 'Temperature Conversions';  
RUN;
```

DATA
step

PROC
step

- A step ends when SAS encounters a DATA, PROC, RUN, QUIT, STOP or ABORT statement

Global SAS statements

- Global statements are not part of DATA or PROC steps
 - Only a few: OPTIONS, TITLE, FOOTNOTE, LIBNAME
 - Stay in effect until changed

```
OPTIONS NODATE;
```

```
TITLE 'Temperature Conversions';
```

```
DATA temps;
```

```
    Fahrenheit = 68;
```

```
    Celsius = (Fahrenheit - 32) * 0.5556;
```

```
PROC PRINT DATA = temps;
```

```
RUN;
```

Global

DATA
step

PROC
step

SAS logs

- When you run SAS programs, you get SAS log containing
 - SAS statements that you submitted
 - Error messages
 - Program will not run!
 - Usually syntax or spelling problem
 - Warnings
 - There may be a problem
 - Notes
 - Data sets read and created
 - Number of observations and variables
 - May indicate a problem

SAS log

Be sure to check your SAS log!

```
1  DATA temps;  
2      Fahrenheit = 68;  
3      Celsius = (Fahrenheit - 32) * 0.5556;
```

NOTE: The data set WORK.TEMPS has 1 observations and 2 variables.

NOTE: DATA statement used (Total process time):

real time	0.01 seconds
cpu time	0.00 seconds

```
4  PROC PRIN DATA = temps;  
ERROR: Procedure PRIN not found.  
5      TITLE 'Temperature Conversions';  
6  RUN;
```

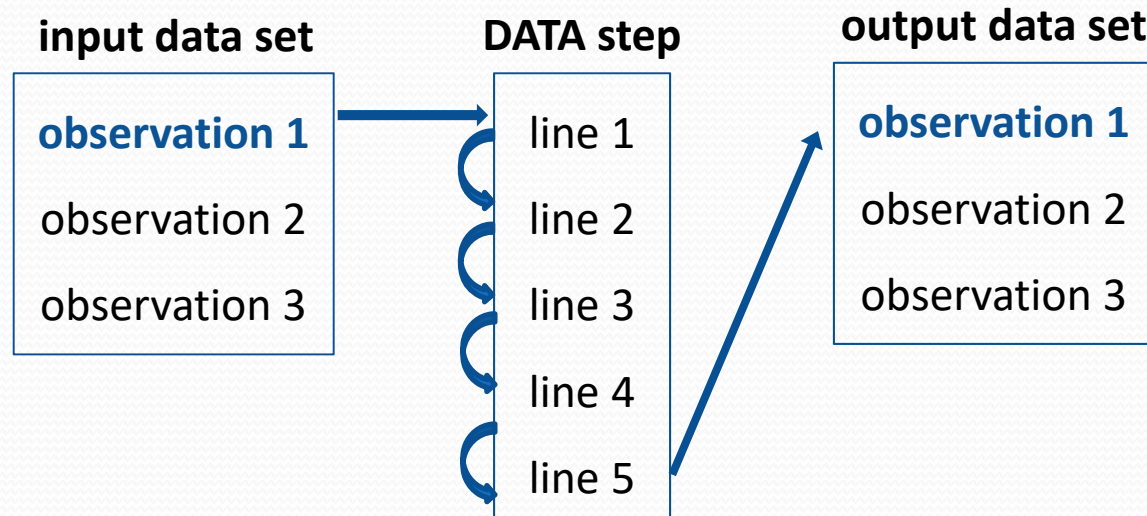
NOTE: The SAS System stopped processing this step because of errors.

NOTE: PROCEDURE PRIN used (Total process time):

real time	0.00 seconds
cpu time	0.00 seconds

DATA step's built-in loop

- DATA steps execute line-by-line and observation-by-observation

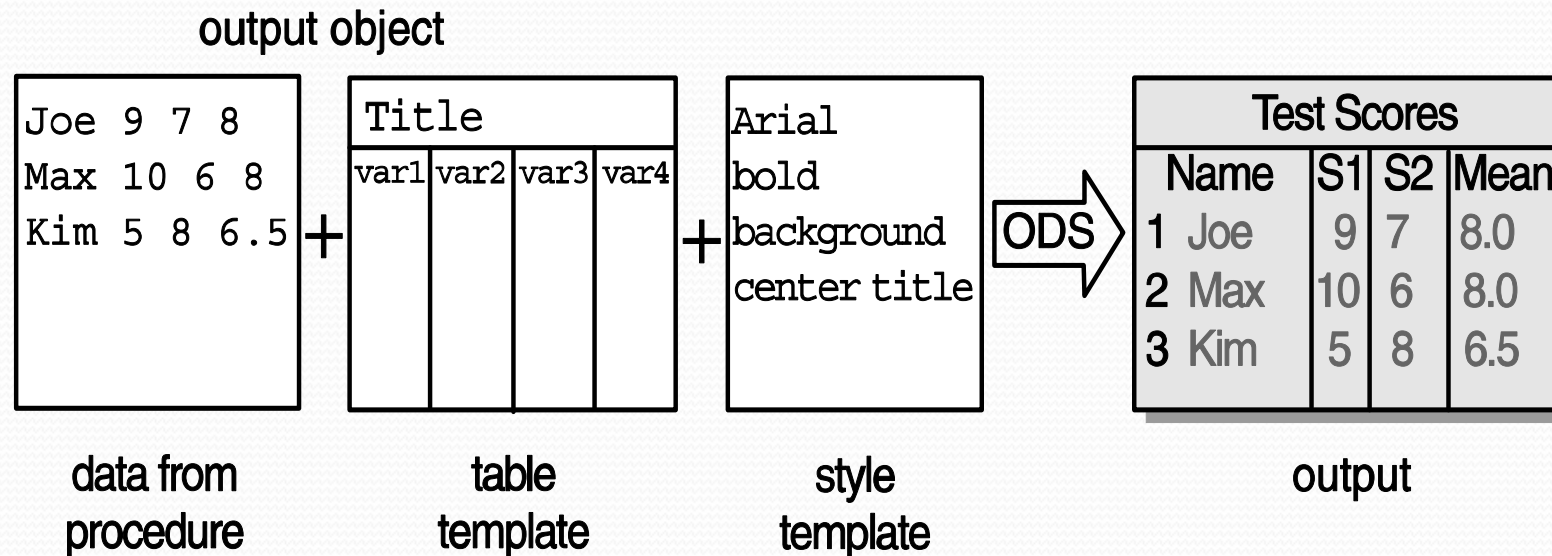


Output Delivery System

- ODS handles all procedure output
- Susan says: You always use ODS!
- Output formats are called destinations
- Many destinations
 - HTML (default starting SAS 9.3)
 - LISTING (text, default SAS 9.2 and earlier)
 - PDF
 - RTF
 - POWERPOINT
 - OUTPUT (SAS data set)

Output Delivery System

- How ODS works:



Resources: Software

- Free software!
 - Free for purposes of learning
 - SAS University Edition
 - SAS Studio interface
 - Download and install virtual machine
 - SAS OnDemand for Academics
 - SAS Studio interface is default
 - Use online, zero footprint



Resources: Training

- Free training!
 - support.sas.com/training/
 - SAS Programming 1: Essentials online self-paced course
 - Statistics 1: Introduction to ANOVA, Regression, and Logistic Regression online self-paced course
 - Nearly 200 free tutorials



Resources: Help

- Free help!
 - communities.sas.com
 - sascommunity.org
 - blogs.sas.com
- Free SAS conference papers!
 - wuss.org
 - lexjansen.com (every SAS conference paper ever published)



Pop quiz

- 1) Officially, what do the letters SAS stand for?
Nothing
- 2) What three interfaces are included with Base SAS?
Display Manager, Enterprise Guide, and SAS Studio
- 3) SAS data sets are comprised of what two basic parts?
Data and descriptor portions
- 4) What are the two types of variables in SAS?
Numeric and character

Pop quiz

5) Someone tells you that the SAS date value for his date of birth is 17. On what date was he born?

January 18, 1960

6) Is this a valid SAS variable name?
ABCDEFGHIJKLMNOPQRSTUVWXYZ

Yes

7) Which SAS data library is temporary?

WORK

Pop quiz

- 8) Every SAS statement ends with what?
A semicolon;
- 9) What are the two basic parts of SAS programs?
DATA and PROC steps
- 10) What is the current default output format in SAS?
HTML

Other presentations

- Next up in this room
 - Introduction to DATA Step Programming: SAS Basics II
 - Introduction to SAS Procedures: SAS Basics III
- Hands-on Workshop Friday 9:00-10:30
 - SAS Studio: A New Way to Program in SAS, Lora Delwiche

Thank you!

I hope you can stay for the next presentation.

Susan Slaughter
Avocet Solutions

Can download slides from
www.avocetsolutions.com

